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DESIGNATED/ELECTED OFFICE (DO/EO/US)  
CONCERNING A FILING UNDER 35 U.S.C. 371**531 Rec'd PCT  
P01,0467

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U.S. APPLICATION NO. (if known, see 37 CFR 1.5)

10/018442

INTERNATIONAL APPLICATION NO.

PCT/DE00/01862

INTERNATIONAL FILING DATE

7 June 2000

PRIORITY DATE CLAIMED

16 June 1999

TITLE OF INVENTION

"GAS-FILLED SURGE DIVERTER WITH ELECTRODE CONNECTIONS IN THE SHAPE OF BAND-TYPE CLIPS"

APPLICANT(S) FOR DO/EO/US

Jürgen Boy and Peter Bobert

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay.
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of International Application as filed (35 U.S.C. 371(c)(2))
  - a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☐ has been transmitted by the International Bureau.
  - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. §371(c)(3))
  - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☐ have been transmitted by the International Bureau.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
  - d. ☒ have not been made and will not be made.
8. ☒ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

**Items 11. to 16. below concern other document(s) or information included:**

11. ☒ An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98; (PTO 1449, Prior Art, Search Report).
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included.  
(SEE ATTACHED ENVELOPE)
13. ☒ A FIRST preliminary amendment.  
☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☒ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information:
  - a. ☒ Submission of Drawings - 2 sheets
  - b. ☒ Submission of Proposed Drawing Changes
  - c. ☒ EXPRESS MAIL #EL843743166US dated December 12, 2001

10/018442

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531 Rec'd PCT 12 DEC 2001

17. ☒ The following fees are submitted:**BASIC NATIONAL FEE (37 C.F.R. 1.492(a)(1)-(5):**

Search Report has been prepared by the EPO or JPO ..... \$890.00

International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) ... \$670.00

No international preliminary examination fee paid to USPTO (37 C.F.R. 1.482) but international search fee paid to USPTO (37 C.F.R. 1.445(a)(2)) ..... \$760.00

Neither international preliminary examination fee (37 C.F.R. 1.482) nor international search fee (37 C.F.R. 1.445(a)(2)) paid to USPTO ..... \$970.00

International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) ..... \$ 96.00

**ENTER APPROPRIATE BASIC FEE AMOUNT =**

CALCULATIONS

PTO USE ONLY

\$ 890.00

Surcharge of \$130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 C.F.R. 1.492(e)).

\$

Claims

Number Filed

Number  
Extra

Rate

Total Claims

20

- 20 =

0

X \$18.00

\$

Independent Claims

1

- 3 =

0

X \$84.00

\$

Multiple Dependent Claims

\$280.00 +

\$

**TOTAL OF ABOVE CALCULATIONS =**

\$ 890.00

Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 C.F.R. 1.9, 1.27, 1.28)

\$

**SUBTOTAL =**

\$ 890.00

Processing fee of \$130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).

\$

+

**TOTAL NATIONAL FEE =**

\$ 890.00

Fee for recording the enclosed assignment (37 C.F.R. 1.21(h). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28, 3.31). \$40.00 per property

+

**SEE  
ATTACHED  
ENVELOPE****TOTAL FEES ENCLOSED =**

\$ 890.00

Amount to be  
refunded

\$

charged

\$

a. ☒ A check in the amount of \$890.00 to cover the above fees is enclosed.b. ☐ Please charge my Deposit Account No. \_\_\_\_\_ in the amount of \$ \_\_\_\_\_ to cover the above fees. A duplicate copy of this sheet is enclosed.c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 501519. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

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Registration Number

IN THE UNITED STATES ELECTED OFFICE OF  
THE UNITED STATES PATENT AND TRADEMARK OFFICE  
UNDER THE PATENT COOPERATION TREATY - CHAPTER II

PRELIMINARY AMENDMENT

5 APPLICANTS: Jürgen Boy and Peter Bobert

ATTORNEY

DOCKET NO.: P01,0467

SERIAL NO.:

EXAMINER:

FILING DATE:

ART UNIT:

10 INTERNATIONAL APPLICATION NO.: PCT/DE00/01862

INTERNATIONAL FILING DATE: 7 June 2000

INVENTION: "GAS-FILLED SURGE DIVERTER WITH ELECTRODE  
CONNECTIONS IN THE SHAPE OF BAND-TYPE CLIPS"

**BOX PCT**

15 Assistant Commissioner for Patents  
Washington, D.C. 20231

S I R:

Please amend the above-identified International Application before entry  
into the National Stage before the U.S. Patent and Trademark Office under 35 USC

20 371 as follows:

IN THE SPECIFICATION:

Please amend the title and the specification by replacing pages 1-7 with the  
attached Substitute Specification.

IN THE CLAIMS:

25 Please cancel claims 1-13, without prejudice, and add the following claims:

5           --14. A gas-filled surge arrester comprising at least two end electrodes with a flange-like foot part, each foot part being soldered to an end face of a hollow-cylindrical ceramic insulator, and each foot part having an electrical terminal, said terminal being a tightly fitting clip having means to cause the clip to be resilient in a circumferential direction, said clip embracing a part of the axial length of the ceramic insulator adjacent the foot part, each clip having a radially projecting terminal.--

          --15. A gas-filled surge arrester according to claim 14, wherein said means is a two-legged clamp-like bend formed in said clip.--

10           --16. A gas-filled surge arrester according to claim 14, having a middle third electrode in addition to the two end electrodes, each clip projecting axially beyond the foot part of the respective end electrode, the projecting region being a part of a short-circuit device electrically connected to the middle electrode.--

15           --17. A gas-filled surge arrester according to claim 16, wherein parts of an auxiliary discharge circuit electrically parallel to the gas discharge path is additionally allocated to the projecting region of the clip.--

20           --18. A gas-filled surge arrester according to claim 17, wherein the short-circuit device comprises a disk-shaped auxiliary electrode having a diameter at least equal to the outside diameter of the clip, said auxiliary electrode being spaced from an edge of the clip by means of a fusion disk and a spacer, which are arranged within the projecting part of the clip, said auxiliary electrode being pressed against the spacer by a spring.--

--19. A gas-filled surge arrester according to claim 18, wherein the spacer is a varistor.--

--20. A gas-filled surge arrester according to claim 18, wherein the spring is fixed by means of a U-shaped shackle to the middle electrode.--

5           --21. A gas-filled surge arrester according to claim 20, wherein the spring is a spring washer.--

--22. A gas-filled surge arrester according to claim 20, wherein the spring is a coil spring.--

10           --23. A gas-filled surge arrester according to claim 14, wherein the clip has the form of a cap with a hollow-cylindrical edge region and a planar cover region provided with a central opening, and the means is the edge region being provided with a plurality of bead-like, circumferentially spaced impressions lying against the foot part of the respective end electrode.--

15           --24. A gas-filled surge arrester according to claim 23, wherein the clip is additionally part of an auxiliary discharge path circuited electrically parallel to the gas discharge path.--

20           --25. A gas-filled surge arrester according to claim 23, which includes a middle electrode being arranged between hollow-cylindrical ceramic insulators, the clip projecting axially beyond the foot part of the respective end electrode and a projecting region being part of a short-circuit device which is electrically connected to the middle electrode.--

--26. A gas-filled surge arrester according to claim 25, wherein the short-circuit device is formed by a planar cover surface of the cap and by an end of a spring clip connected to the center electrode that is free and engaged into the center opening of the cap, the free end of the spring clip being held spaced from the planar cover surface of the cap by means of a fusion disk and the auxiliary discharge path being arranged within the cap and the fusion disk and auxiliary discharge path being insulated from the planar cover of the cap by means of an insulating centering member.--

--27. A gas-filled surge arrester according to claim 26, wherein the auxiliary discharge path is composed of a varistor that is arranged and insulated by means of the insulating centering member.--

--28. A gas-filled surge arrester according to claim 14, wherein a middle electrode is arranged between the hollow-cylindrical ceramic insulators, the clip projecting axially beyond a foot part of the respective end electrode, a projecting region being part of a short-circuit device electrically connected to the middle electrode and the means is a two-legged clamp-like bend.--

--29. A gas-filled surge arrester according to claim 28, wherein parts of an auxiliary discharge path circuited electrically parallel to the gas discharge path are additionally allocated to the projecting region of each clip.--

--30. A gas-filled surge arrester according to claim 29, wherein the short circuit device comprises a disk-shaped auxiliary electrode having a diameter at least equal to the outside diameter of the clip, said auxiliary electrode being held spaced from the edge of the clip by means of a fusion disk and a spacer that are arranged

within the projecting part of the clip and said auxiliary electrode being pressed against the spacer by a spring.--

--31. A gas-filled surge arrester according to claim 30, wherein the spacer is composed of a varistor.--

5           --32. A gas-filled surge arrester according to claim 30, wherein the spring is fixed to the middle electrode by a U-shaped shackle.--

--33. A gas-filled surge arrester according to claim 32, wherein the spring is a spring washer.--

**IN THE ABSTRACT:**

10           Please replace the Abstract with the Abstract of the Disclosure attached herewith on an unnumbered page. A marked-up version is provided in the appendix.

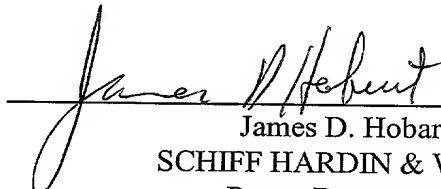
**REMARKS**

Claims 14-33 are presented for examination.

By this amendment, the translation of the PCT Application has been replaced by a Substitute Specification, which corrects grammatical errors and provides headings. The changes in the original specification are provided in the marked-up version, which is attached as an appendix.

Claims 1-13, which were accepted and found patentable by the Preliminary Examination Report of December 22, 2000, have been rewritten as claims 14-33 to place them in form for examination in the United States Patent Office and to remove multiple-dependency. These amendments do not change the structure being recited in the claims and merely change the form of presentation. Thus, it is submitted that claims 14-33 are allowable over the prior art cited in the International Search Report, in view of the above-mentioned Preliminary Examination Report.

Respectfully submitted,

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DATED: December 12, 2001



## ABSTRACT OF THE DISCLOSURE

In order to simplify the mountability of electrode terminals in the form of band-like clips on either two-electrode or three-electrode arresters, the clips are resiliently fashioned in a circumferential direction. When such a clip axially projects beyond a foot part of the respective end electrode, the projecting region in a three-electrode arrester can be part of a short-circuit device which electrically connects to the middle electrode, potentially in combination with an auxiliary discharge path.

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## TITLE

"GAS-FILLED SURGE ARRESTER WITH BAND-LIKE  
CLIPS FORMING THE ELECTRODE TERMINALS"

## BACKGROUND OF THE INVENTION

5 The invention is in the field of over-voltage protection for communication networks and is concerned with the structural design of the power feed elements to the electrodes of a gas-filled surge arrester.

10 For protection against over-voltages as can occur, among other things, due to lightning strikes, gas-filled surge arresters are employed in communication networks and the appertaining devices that comprise one or two or, respectively, three discharge paths and, for this purpose, are composed of two end electrodes and, potentially, of a further electrode in the form of a middle electrode as well as of one or two hollow-cylindrical ceramic insulators.

15 In two-electrode surge arresters, the ceramic insulator usually has its end face soldered to the end electrodes (see US 4,266,260 A). In three-electrode surge arresters, the ceramic insulators are soldered at their circumferential end faces to both the middle electrode as well as to a respective end electrode (see US 3,885,203 A and US 4,212,047 A). The contacting of the electrodes at their outer circumference usually occurs either within a housing with the assistance of resilient clamps or with  
20 the assistance of leads that have their one end soldered or welded tangentially, radially or axially to a respective electrode and have their other end provided with a pluggable contact element or fashioned for a soldering (see US 4,212,047 and US 4,984,125 A). In order to fashion the power feed elements in gas-filled surge

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arresters of the higher performance category so that they are also sure to withstand extreme current loads, it is also known to employ power feed elements in the form of a band-like clip that are fixed to the circumference of the surge arrester with a releasable clamp closure. A riveting or an ultrasound welding also come into consideration as a non-releasable clamp closure. In addition, the band-like clips can be fashioned so broad that they embrace not only the electrically conductive foot region of the respective end electrode but also the adjoining ceramic insulator over a respective part of the axial length of the insulator. As a result thereof, the electrical behavior of the surge arrester can be positively influenced (see DE 196 41 385 A1/US 5,768,082 A).

It is also known to arrange additional component parts at the face end of the end electrodes of three-electrode arresters in order to realize a short-circuit device (fail safe mechanisms) and/or in order to connect auxiliary discharge paths electrically parallel to the gas discharge paths. For radial fixing of the component parts, specific designs in the foot region of the end electrodes and a cap that resides under the influence of a spring and is electrically connected to the middle electrode of the surge arrester are employed (see US 5,388,023 A; US 5,633,777 A and US 4,984,125 A/Figure 1a).

#### SUMMARY OF THE INVENTION

For a gas-filled surge arrester having band-like clips, the invention is based on the object of simplifying the mountability of the band-like clips and to thereby expand their function as far as possible.

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For achieving this object, it is first provided that each clip allocated to an end electrode is resiliently fashioned in the circumferential direction. This can be realized, for example, in that clip is provided with a two-leg, clamp-like batter or bend. The clip can also be lent the form of a cap that comprises a hollow-cylindrical edge region and a planar cover region provided with a center opening, whereby the edge region has its circumference provided with a plurality of bead-like impressed portions that lie against the foot part of the respective end electrode. Given such a design of the clip, the electrical terminal of the respective end electrode can be prefabricated in the framework of an automatic manufacturing sequence and can also be slipped onto the respective end electrode. The spring tension of the clip thereby suffices in order to assure a reliable contacting of the respective end electrode given normal and medium current load.

A clip fashioned according to the invention can also exercise other functions when it is utilized for contacting given three-electrode arresters and is fashioned broad enough. In this case, the clip can be put in place on the surge arrester so that the chip projects axially beyond the foot part of the respective end electrode by a certain length. Parts of a short-circuit device electrically connected to the middle electrode can be allocated to this projecting region of the clip, as can, additionally, parts of an auxiliary discharge path connected electrically parallel to the gas discharge path. To this end, a fusion disk and a spacer are arranged within the projecting region of the clip. With a clip with a clamp-like batter or bend, a disk-shaped auxiliary electrode can also be allocated to the clip and has a diameter of at least equal to the outside diameter of the clip. The auxiliary electrode is held spaced from the edge of the clip by the fusion disk and the spacer and is pressed against the spacer by a spring. This spring can be a matter of a known spring clip (see Figure 1

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of US 4,984,125). However, a coil spring or a spring washer can also be employed and is fixed by a U-shaped shackle secured to the middle electrode. In a known way, the spacer holding the disk-shaped auxiliary electrode spaced from the edge of the clip can be an insulating member or -- preferably -- a varistor (see Figure 1 of US 5,388,023).

Instead of a disk-shaped auxiliary electrode, a cap-like auxiliary electrode (similar to part 37 of Figure 3 of United States Letters Patent 5,633,777 and part 15 of Figure 1 of United States Letters Patent 5,388,023) can also be provided and is under the influence of a spring clip electrically connected to the middle electrode. The cap-like electrode has an edge projecting into the projecting region of the clip, accepts the fusion disk and the spacer, and is held insulated and spaced from the clip by a ring-like insulator part.

In the case of a clip in the form of a cap, the short-circuit device is formed by the planar cover surface of the cap and by a free end of a spring clip which is connected to the center electrode and which free end engages into the center opening of the cap. The free end of the spring clip is held spaced from the planar cover surface of the cap by means of a fusion disk and the auxiliary discharge path that are arranged within the cap, and the fusion disk or the auxiliary discharge path is insulated from the planar cover surface of the cap by means of an insulating centering member. The auxiliary discharge path is composed of a varistor that is arranged in the cap and insulated from the cap by the insulating centering member. However, a perforated mica folium can also serve as auxiliary discharge path and the fusion disk, which lies thereagainst, is insulated from the cap.

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A number of exemplary embodiments of surge arresters fashioned according to the invention are shown in Figures 1 through 8.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of a three-electrode arrester with a first  
5 embodiment of clip allocated to the end electrodes;

Figure 2 is a perspective view of a two-electrode arrester with a first  
embodiment of clip allocated to the two electrodes;

Figure 3 is a partial side view with portions broken away of a three-  
electrode arrester having clips according to Figure 1 and with the short-circuit device,  
10 which is combined with an auxiliary discharge path, being allocated to an end  
electrode;

Figure 4 is a partial side view with portions broken away of a modification  
of the device of Figure 3 with an auxiliary electrode fashioned as cap;

Figure 5 is a partial side view with portions broken away of another  
15 modification of the device of Figure 3 with rigid retainer shackle for the short-circuit  
device and a spring washer allocated to the auxiliary electrode;

Figure 5A is a side view of the spring washer in a relaxed condition;

Figure 6 is a perspective view of a two-electrode arrester with a second  
embodiment of a clip to be allocated thereto;

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Figure 7 is a perspective view of a three-electrode arrester with clips in the form of a cap allocated to the end electrodes; and

Figure 8 is a partial side view with portions broken away of a three-electrode arrester with clips according to Figure 7 and with the short-circuit device, which is combined with an auxiliary discharge path, being allocated to an end electrode.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 shows a schematic illustration of a three-electrode arrester 1 that comprises the two ceramic insulators 11 and 12 at both sides of a middle electrode 13 and on whose one end electrode (not shown) an electrical terminal in the form of a tightly fitting clip 2 is put in place. An identical clip 2 is shown next to the end electrode 14. This clip, which is composed of an annular metal band 21 whose ends are soldered or welded to form a radially projecting terminal 22, has its circumference provided with a two-legged, clamp-like batter or protrusion 23 lying approximately opposite the terminal 22, as a result whereof the clip 2 is rendered resilient in a circumferential direction. The clip can be slipped onto the flange-like foot part 15 of the end electrode 14, whereby the dimensions of the foot part 15 of the end electrode 14 and of the clip 2 are selected so that an adequate contact pressure is established. In particular, the diameter of the foot part 15 should be slightly larger than the diameter of the ceramic insulator 11 or, respectively, 12.

Figure 2 shows a two-electrode arrester that comprises a ceramic insulator 31, a first end electrode 33 as well as a second end electrode (not shown in detail) and a resiliently fashioned clip 2 is put in place on each end electrode.

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Figure 3 shows portions of a three-electrode arrester according to Figure 1 that is augmented by a short-circuit device and combined with auxiliary discharge paths. In this case, the width  $b$  of the clip 24 put in place onto the foot 15 of the end electrode 14 is selected so large that the clip not only embraces a part of the surface of the ceramic insulator 12 but also projects axially beyond the end electrode 14. As a result thereof, a cylindrical space is formed in which a disk 4 of a fusible material and a spacer 5 in the form of a varistor are arranged. The spacer 5 is arranged and centered within the clip 24 by means of a rubber-like ring 6. The assembly composed of the fusion disk 4 and the varistor 5 also has a centrally perforated auxiliary electrode 7 allocated to it and the electrode 7 lies against the spacer/varistor 5 and is held by the free end of a spring clip 8 fixed to the middle electrode 13. The fusion disk 4 melts in case of an overload, whereupon the auxiliary electrode 7 contacts the edge of the clip 24.

Figure 4 shows a modification of the device of Figure 3, whereby the critical difference is that a cap-shaped auxiliary electrode 84 is provided instead of a disk-shaped auxiliary electrode 7, a fusion disk 41 and a spacer/varistor 5 are arranged in the auxiliary electrode 84 and an edge 85 of the electrode 84 is residing opposite the foot part 15 of the end electrode within the projecting region of the clip 24. The auxiliary electrode 84 is arranged and centered by an insulating ring 10 and is held spaced and insulated from the clip 24.

Figure 5 shows another modification of the device of Figure 3, whereby the critical difference is that the contact to the middle electrode 13 is produced via a non-resilient, U-shaped shackle 82 that presses a spring washer 83 against the auxiliary electrode 71. The spring washer 83, which is shown in its relaxed condition in

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Figure 5A, lies against the disk-shaped auxiliary electrode 71 that has both sides provided with a centering surface 73 for the centered allocation of the spring washer 83 and a centering surface 72 for the centered allocation of the spacer/varistor 5 within the projecting region of the clip 24.

5           Figure 6 shows a two-electrode arrester 3 with ceramic insulator 31 and end electrodes 33 and 34, whereby a clip 25 in the form of a cap with a hollow-cylindrical edge region 26 and a planar cover or end region 27 provided with a center opening 28 is to be allocated to each end electrode. The cap 25 is also implemented with a power terminal 29. In addition, the clip 25 has the circumference of the edge region  
10           26 provided with a plurality of point-like or bead-like impressions 30, 50 that, when the clip or cap 25 is slipped onto an end electrode, the cap resiliently presses onto the foot region of the respective end electrode and forms a contact therewith.

15           Figure 7 shows a three-electrode arrester 1 on whose end electrodes a respective clip or cap 25 is put in place. According to Figure 8, a three-electrode arrester according to Figure 7 and the cap 25 can likewise be part of a short-circuit device connected to the middle electrode 13 and can potentially additionally be part of an auxiliary discharge path connected electrically parallel to the gas discharge path of the arrester. The cap 25 has adequate height h in order to be able to receive a fusion disk 4 and a spacer 5 within the cap. The spacer 5 in the form of a varistor is  
20           arranged upon employment of an insulating centering member 9 in order to suppress a short-circuit between the free end 84 of the spring clip 8 and the cap 25 in the normal operating condition.

WE CLAIM:

1.

1004844-1

SUBSTITUTE SPECIFICATION

TITLE

1

Band-like clips Forming the

GAS-FILLED SURGE ARRESTER WITH ELECTRODE TERMINALS IN

~~THE FORM OF BAND-LIKE CLIPS~~Background of the Invention

The invention is in the field of over-voltage protection for communication networks and is concerned with the structural design of the power feed elements to the electrodes of a gas-filled surge arrester.

For protection against over-voltages as can occur, among other things, due to lightning strikes, gas-filled surge arresters are employed in communication networks and the appertaining devices that comprise one or two or, respectively, three discharge paths and, for this purpose, are composed of two end electrodes and, potentially, of a further electrode in the form of a middle electrode as well as of one or two hollow-cylindrical ceramic insulators.

<sup>In</sup> Given two-electrode surge arresters, the ceramic insulator usually has its end face soldered to the end electrodes <sup>(see</sup> (US 4,266,260 A), <sup>In</sup> given three-electrode surge arresters, the ceramic insulators are soldered <sup>both</sup> either at their circumference <sup>at</sup> at end faces <sup>both</sup> both to the middle electrode as well as to a respective end electrode <sup>(see</sup> (US 3,885,203 A, and US 4,212,047 A). The contacting of the electrodes at their outer circumference <sup>usually occurs</sup> thereby ensues either within a housing with the assistance of resilient clamps or with the assistance of leads that have their one end soldered or welded tangentially, radially or axially to a respective electrode and <sup>that</sup> have their other end provided with a pluggable contact element or fashioned for a soldering <sup>(see</sup> (US 4,212,047, <sup>and</sup> US 4,984,125 A). In order to fashion the power feed elements in gas-filled surge arresters of the higher performance category <sup>so</sup> such that they are also sure to withstand extreme current loads, it is also known to employ power feed elements in the form of a band-like clip that are fixed to the circumference of the surge arrester with a releasable clamp closure. A riveting or an ultrasound welding also come into consideration as <sup>a</sup> non-releasable clamp closure. <sup>In addition</sup> Further, the band-like clips can be fashioned so broad that they embrace not only the electrically conductive foot region of the respective end electrode but also the adjoining ceramic insulator over a respective part of <sup>its</sup> its axial length. <sup>of the insulator,</sup> As a result thereof, the electrical behavior of the surge arrester can be positively influenced <sup>(see</sup> (DE 196 41 385 A1/US 5,768,082 A).

MARKED-UP  
VERSION

2  
additional

It is also known to arrange ~~further~~<sup>additional</sup> component parts at the face end of the end electrodes of three-electrode arresters in order to realize <sup>a</sup> short-circuit device (fail safe mechanisms) and/or in order to connect auxiliary discharge paths electrically parallel to the gas discharge paths. For radial fixing of the component parts, specific designs in the foot region of the end electrodes and a cap that resides under the influence of a spring and is electrically connected to the middle electrode of the surge arrester are employed <sup>(see</sup> US 5,388,023 A; US 5,633,777 A, <sup>and</sup> US 4,984,125 A/ Figure 1a) ~~are~~<sup>employed</sup>.

Summary of the Invention

<sup>For</sup> Proceeding from a gas-filled surge arrester <sup>having band-like clips,</sup> ~~having the features of the preamble~~ of patent claim 1, the invention is based on the object of simplifying the mountability of the band-like clips and to thereby expand their function as far as possible.

For achieving this object, it is first provided that each clip allocated to an end electrode is resiliently fashioned in <sup>the</sup> circumferential direction. This can be realized, for example, in that clip is provided <sup>with</sup> by means of ~~[sic]~~ a two-leg, clamp-like <sup>or band</sup> batter. The clip can also be lent the form of a cap that comprises a hollow-cylindrical edge region and a planar cover region provided with a center opening, whereby the edge region has its circumference provided with a plurality of bead-like impressed portions that lie against the foot part of the respective end electrode. Given such a design of the clip, the electrical terminal of the respective end electrode can be prefabricated in the framework of an automatic manufacturing sequence and can also be slipped onto the respective end electrode. The spring tension of the clip thereby suffices in order to assure a reliable contacting of the respective end electrode given normal and medium current load.

A clip fashioned according to the invention can also exercise other functions when it is utilized for contacting given three-electrode arresters and is fashioned broad enough. In this case, the clip can be put in place ~~and~~ <sup>so the clip</sup> on the surge arrester ~~that is~~ projects axially beyond the foot part of the respective end electrode by a certain length. Parts of a short-circuit device electrically connected to the middle electrode can be allocated to this projecting region of the clip, as can, additionally, parts of an auxiliary discharge path connected electrically parallel to the gas discharge path, ~~as warranted~~. To this end, a fusion disk and a spacer are arranged within the projecting

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region of the clip, <sup>with</sup> a clip with a clamp-like <sup>or band</sup> ~~batter~~ a disk-shaped auxiliary electrode can also be allocated to the clip, <sup>and having</sup> the diameter thereof <sup>is</sup> being at least equal to the outside diameter of the clip, <sup>The</sup> and said auxiliary electrode <sup>is</sup> being held spaced from the edge of the clip by the fusion disk and the spacer and <sup>is</sup> being pressed against the spacer by a spring. This spring can be a matter of a known spring clip <sup>(see Figure 1 of</sup> (US 4,984,125, <sup>and is</sup> Figure 1). However, a coil spring or a spring washer can also be employed, <sup>this being</sup> fixed by a U-shaped shackle secured to the middle electrode. In a known way, the spacer holding the disk-shaped auxiliary electrode spaced from the edge of the clip can be an insulating member or -- preferably -- a varistor <sup>(see Figure 1 of</sup> (US 5,388,023, Figure 4).

Instead of a disk-shaped auxiliary electrode, a cap-like auxiliary electrode, <sup>part 37 of Figure 3 of</sup> (similar to, United States Letters Patent 5,633,777, Figure 3, part <sup>and</sup> 15 of Figure 1 of United States Letters Patent 5,388,023, <sup>and is</sup> Figure 1, part 15) can also be provided, <sup>this being</sup> under the influence of a spring clip electrically connected to the middle electrode, <sup>The cap-like electrode has</sup> and having its <sup>an</sup> edge projecting into the projecting region of the clip, <sup>and accepts</sup> accepting the fusion disk and the spacer, and <sup>is</sup> being held insulated and spaced from the clip by a ring-like insulator part.

In the case of a clip in the form of a cap, the short-circuit device is formed by the planar cover surface of the cap and by <sup>the free</sup> that end of a spring clip <sup>which is</sup> connected to the center electrode <sup>and which free end</sup> that is free and engages into the center opening of the cap, <sup>whereby</sup> the short-circuit device is formed by the planar cover surface of the cap and by that end of a spring clip connected to the center electrode that is free and engages into the center opening of the cap, <sup>whereby</sup> the free end of the spring clip is held spaced from the planar cover surface of the cap by means of a fusion disk and the auxiliary discharge path that are arranged within the cap, and the fusion disk or the auxiliary discharge path is insulated from the planar cover surface of the cap by means of an insulating centering member. <sup>is it</sup> Here, too, the auxiliary discharge path is composed of a varistor that is arranged <sup>in the cap and from the cap by</sup> insulated by means of the insulating centering member. However, a perforated mica folium can also serve as auxiliary discharge path, <sup>and</sup> the fusion disk <sup>which is</sup> lying thereagainst, insulated from the cap.

A number of exemplary embodiments of surge arresters fashioned according to the invention are shown in Figures 1 through 8. ~~Whereby shown are:~~

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# Brief Description of the 4 Drawings

- Figure 1 is a perspective view of a three-electrode arrester with a first embodiment of clip allocated to the end electrodes;
- Figure 2 is a perspective view of a two-electrode arrester with a first embodiment of clip allocated to the two electrodes;
- Figure 3 is a partial side view with portion broken away of a three-electrode arrester having clips according to Figure 1 and with the short-circuit device allocated to an end electrode, said short-circuit device being combined with an auxiliary discharge path, being
- Figure 4 is a modification of Figure 3 with an auxiliary electrode fashioned as cap;
- Figure 5 is a modification of Figure 3 with rigid retainer shackle for the short-circuit device and a spring washer allocated to the auxiliary electrode;
- Figure 5A is a side view of the spring washer in a relaxed condition; Also shown are
- Figure 6 is a perspective view of a two-electrode arrester with a second embodiment of a clip to be allocated thereto;
- Figure 7 is a perspective view of a three-electrode arrester with clips in the form of a cap allocated to the end electrodes; and
- Figure 8 is a partial side view with portion broken away of a three-electrode arrester with clips according to Figure 7 and with the short-circuit device allocated to an end electrode, which is said short-circuit device being combined with an auxiliary discharge path, being

## Description of the Preferred Embodiments

Figure 1 shows a schematic illustration of a three-electrode arrester 1 that comprises the two ceramic insulators 11 and 12 at both sides of a middle electrode 13 and on whose one end electrode (not shown) an electrical terminal in the form of a tightly fitting clip 2 is put in place. An identical clip 2 is shown next to the end electrode 14. This clip, which is composed of an annular metal band 21 whose ends are soldered or welded to form a terminal 22, has its circumference provided with a two-legged, clamp-like batter 23 lying approximately opposite the terminal 22, as a result whereof the clip 2 is rendered resilient in circumferential direction. The clip can be slipped onto the flange-like foot part 15 of the end electrode 14, whereby the dimensions of the foot part 15 of the end electrode 14 and of the clip 2 are selected so such that an adequate contact pressure is established. In particular, the diameter of the

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foot part 15 should be slightly larger than the diameter of the ceramic insulator 11 or, respectively, 12.

Figure 2 shows a two-electrode arrester that comprises a ceramic insulator 31, a first end electrode 33 as well as a second end electrode (not shown in detail), *and*   
 5 ~~whereby~~ a resiliently fashioned clip 2 is put in place on each end electrode.

Figure 3 shows portions of a three-electrode arrester according to Figure 1 that is augmented by a short-circuit device and combined with auxiliary discharge paths. In this case, the width b of the clip 24 put in place onto <sup>foot 15 of the</sup> end electrode 14 is selected so large that the clip not only embraces a part of the surface of the ceramic.   
 10 insulator 12 but also projects axially beyond the end electrode 14. As a result thereof, a cylindrical space is formed in which a disk 4 of a fusible material and a spacer 5 in the form of a varistor are arranged, ~~whereby~~ <sup>and</sup> the spacer 5 is arranged <sup>to</sup> centered within the clip 24 by means of a rubber-like ring 6. The assembly composed of fusion disk 4.   
 and <sup>the</sup> varistor 5 also has a centrally perforated auxiliary electrode 7 allocated to it <sup>one to</sup> that   
 15 <sup>electrode?</sup> lies against the spacer/varistor 5 and is held by the free end of a spring clip 8 fixed to the middle electrode 13. The fusion disk 4 melts in case of <sup>an</sup> overload, whereupon the auxiliary electrode 7 contacts the edge of the clip 24.

Figure 4 shows a modification of <sup>the device of</sup> Figure 3, whereby the critical difference is ~~comprised therein~~ that a cap-shaped auxiliary electrode 84 is provided instead of a   
 20 disk-shaped auxiliary electrode, a fusion disk 41 and a spacer/varistor 5 <sup>and</sup> being arranged in <sup>the</sup> said auxiliary electrode 84 and <sup>on</sup> the edge 85 thereof <sup>of the electrode 84 is</sup> residing opposite the foot part 15 of the end electrode within the projecting region of the clip 24. The auxiliary electrode 84 is arranged <sup>and</sup> centered by an insulating ring 10 and is held spaced and insulated from the clip 24.

Figure 5 shows another modification <sup>of the device</sup> of Figure 3, whereby the critical difference is ~~comprised therein~~ that the contact to the middle electrode 13 is produced   
 25 via a non-resilient, U-shaped shackle 82 that presses a spring washer 83 against the auxiliary electrode 71. The spring washer <sup>83, which is</sup> shown in its relaxed condition <sup>in Figure 5A,</sup> to the   
 ~~right of the arrester~~ lies against the disk-shaped auxiliary electrode 71 that has both   
 30 sides provided with <sup>73</sup> centering surfaces <sup>72</sup> or, respectively, <sup>74</sup> for the centered

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6  
a centering surface 72  
allocation of the spring washer 83 and for the centered allocation of the  
spacer/varistor 5 within the projecting region of the clip 24.

Figure 6 shows a two-electrode arrester 3 with ceramic insulator 31 and end  
electrodes 33 and 34, whereby a clip 25 in the form of a cap with a hollow-cylindrical  
5 edge region 26 and a planar cover region 27 provided with a center opening 28 is to  
be allocated to each end electrode. The cap 25 is also implemented with a power  
terminal 29. Further, the cap has the circumference of the edge region 26 provided  
with a plurality of point-like or bead-like impressions 30, that, when the cap 25 is  
10 slipped onto an end electrode, result therein that the cap resiliently presses onto the foot  
region of the respective end electrode and forms a contact surface therewith.

Figure 7 shows a three-electrode arrester 1 on whose end electrodes a  
respective clip 25 is put in place. According to Figure 8, and given a three-electrode  
arrester according to Figure 7, the cap can likewise be part of a short-circuit device  
15 connected to the middle electrode 13 and can potentially additionally be part of an  
auxiliary discharge path connected electrically parallel to the gas discharge path of the  
arrester. The cap 25 has adequate height h in order to be able to receive a fusion  
disk 4 and a spacer 5 within the cap is employed for this purpose, whereby the spacer 5  
20 in the form of a varistor is arranged upon employment of an insulating centering  
member 9 in order to suppress a short-circuit between the free end 84 of the spring  
clip 8 and the cap 25 in the normal operating condition.

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We claim

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~~Patent Claims~~

1. Gas-filled surge arrester with at least two electrodes, whereof two electrodes are fashioned as end electrodes with a flange-like foot part, and with at least one hollow-cylindrical ceramic insulator whose face end is soldered to the foot part of an electrode and to a further electrode, whereby the foot part of each end electrode has an electrical terminal allocated to it in the form of a tightly fitting clip that also embraces the ceramic insulator adjacent to the foot part over a part of its axial length and whose radially projecting ends are positively connected to one another, characterized in that each clip (2; 24, 25) is resiliently fashioned in circumferential direction.

2. Gas-filled surge arrester according to claim 1, characterized in that the clip is provided by means of a two-legged, clamp-like member (23).

3. Gas-filled surge arrester according to claim 1 or 2, whereby a middle electrode as third electrode is arranged in addition to two end electrodes, characterized in that the clip (24) projects axially beyond the foot part (14) of the respective end electrode, whereby the projecting region has parts of a short-circuit device (4, 7, 24) (fail-safe mechanism) electrically connected to the middle electrode allocated to it.

4. Gas-filled surge arrester according to claim 3, characterized in that parts of an auxiliary discharge path (5) circuited electrically parallel to the gas discharge path are additionally allocated to the projecting region of the clip (24).

5. Gas-filled surge arrester according to claim 4, characterized in that the short-circuit device comprises a disk-shaped auxiliary electrode (7) whose diameter is at least equal to the outside diameter of the clip (24) and that is held spaced from the edge of the clip by means of a fusion disk (4) and a spacer (5) that are arranged within the projecting part of the clip, and that is pressed against the spacer (5) with a spring (8).

6. Gas-filled surge arrester according to claim 5, characterized in that the spacer (5) is composed of a varistor.

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# Abstract of the Disclosed

## Gas-Filled Surge Arrester with Electrode Terminals in the Form of Band-Like Clips

In order to simplify the mountability of electrode terminals in the form of band-like clips <sup>on either</sup> (24) given two-electrode or three-electrode arresters, <sup>the clips</sup> these are resiliently ~~(23)~~ <sup>a</sup> fashioned in circumferential direction. When such a clip axially projects beyond the <sup>a</sup> foot part (14) of the respective end electrode, the projecting region in <sup>a</sup> three-electrode arresters can be part of a short-circuit device ~~(24, 4, 7, 8)~~ <sup>which</sup> electrically connected <sup>to</sup> the middle electrode (13), potentially in combination with an auxiliary discharge path (5).

10 ~~Figure 3~~

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**GAS-FILLED SURGE ARRESTER WITH ELECTRODE TERMINALS IN  
THE FORM OF BAND-LIKE CLIPS**

The invention is in the field of over-voltage protection for communication networks and is concerned with the structural design of the power feed elements to the electrodes of a gas-filled surge arrester.

For protection against over-voltages as can occur, among other things, due to lightning strikes, gas-filled surge arresters are employed in communication networks and the appertaining devices that comprise one or two or, respectively, three discharge paths and, for this purpose, are composed of two end electrodes and, potentially, of a further electrode in the form of a middle electrode as well as of one or two hollow-cylindrical ceramic insulators.

Given two-electrode surge arresters, the ceramic insulator usually has its end face soldered to the end electrodes (US 4,266,260 A); given three-electrode surge arresters, the ceramic insulators are soldered either at their circumference at end face both to the middle electrode as well as to a respective end electrode (US 3,885,203 A, US 4,212,047 A). The contacting of the electrodes at their outer circumference thereby ensues either within a housing with the assistance of resilient clamps or with the assistance of leads that have their one end soldered or welded tangentially, radially or axially to a respective electrode and that have their other end provided with a pluggable contact element or fashioned for a soldering (US 4,212,047, US 4,984,125 A). In order to fashion the power feed elements in gas-filled surge arresters of the higher performance category such that they are also sure to withstand extreme current loads, it is also known to employ power feed elements in the form of a band-like clip that are fixed to the circumference of the surge arrester with a releasable clamp closure. A riveting or an ultrasound welding also come into consideration as non-releasable clamp closure. Further, the band-like clips can be fashioned so broad that they embrace not only the electrically conductive foot region of the respective end electrode but also the adjoining ceramic insulator over a respective part of its axial length. As a result thereof, the electrical behavior of the surge arrester can be positively influenced (DE 196 41 385 A1/US 5,768,082 A).

It is also known to arrange further component parts at the face end of the end electrodes of three-electrode arresters in order to realize short-circuit device (fail safe mechanisms) and/or in order to connect auxiliary discharge paths electrically parallel to the gas discharge paths. For radial fixing of the component parts, specific designs in the foot region of the end electrodes and a cap that resides under the influence of a spring and is electrically connected to the middle electrode of the surge arrester are employed (US 5,388,023 A, US 5,633,777 A, US 4,984,125 A/Figure 1a) are employed.

Proceeding from a gas-filled surge arrester having the features of the preamble of patent claim 1, the invention is based on the object of simplifying the mountability of the band-like clips and to thereby expand their function as far as possible.

For achieving this object, it is first provided that each clip allocated to an end electrode is resiliently fashioned in circumferential direction. This can be realized, for example, in that clip is provided by means of [sic] a two-leg, clamp-like batter. The clip can also be lent the form of a cap that comprises a hollow-cylindrical edge region and a planar cover region provided with a center opening, whereby the edge region has its circumference provided with a plurality of bead-like impressed portions that lie against the foot part of the respective end electrode. Given such a design of the clip, the electrical terminal of the respective end electrode can be prefabricated in the framework of an automatic manufacturing sequence and can also be slipped onto the respective end electrode. The spring tension of the clip thereby suffices in order to assure a reliable contacting of the respective end electrode given normal and medium current load.

A clip fashioned according to the invention can also exercise other functions when it is utilized for contacting given three-electrode arresters and is fashioned broad enough. In this case, the clip can be put in place such on the surge arrester that is projects axially beyond the foot part of the respective end electrode by a certain length. Parts of a short-circuit device electrically connected to the middle electrode can be allocated to this projecting region of the clip, as can, additionally, parts of an auxiliary discharge path connected electrically parallel to the gas discharge path, as warranted. To this end, a fusion disk and a spacer are arranged within the projecting

region of the clip; given a clip with a clamp-like batter, a disk-shaped auxiliary electrode can also be allocated to the clip, the diameter thereof being at least equal to the outside diameter of the clip, and said auxiliary electrode being held spaced from the edge of the clip by the fusion disk and the spacer and being pressed against the spacer by a spring. This spring can be a matter of a known spring clip (US 4,984,125, Figure 1). However, a coil spring or a spring washer can also be employed, this being fixed by a U-shaped shackle secured to the middle electrode. In a known way, the spacer holding the disk-shaped auxiliary electrode spaced from the edge of the clip can be an insulating member or -- preferably -- a varistor (see US 5,388,023, Figure 1).

Instead of a disk-shaped auxiliary electrode, a cap-like auxiliary electrode (similar to United States Letters Patent 5,633,777, Figure 3, part and United States Letters Patent 5,388,023, Figure 1, part 15) can also be provided, this being under the influence of a spring clip electrically connected to the middle electrode and having its edge projecting into the projecting region of the clip, accepting the fusion disk and the spacer, and being held insulated and spaced from the clip by a ring-like insulator part.

In the case of a clip in the form of a cap, the short-circuit device is formed by the planar cover surface of the cap and by that end of a spring clip connected to the center electrode that is free and engages into the center opening of the cap, whereby the short-circuit device is formed by the planar cover surface of the cap and by that end of a spring clip connected to the center electrode that is free and engages into the center opening of the cap, whereby the free end of the spring clip is held spaced from the planar cover surface of the cap by means of a fusion disk and the auxiliary discharge path that are arranged within the cap, and the fusion disk or the auxiliary discharge path is insulated from the planar cover surface of the cap by means of an insulating centering member. [sic!] Here, too, the auxiliary discharge path is composed of a varistor that is arranged insulated by means of the insulating centering member. However, a perforated mica folium can also serve as auxiliary discharge path, the fusion disk lying thereagainst insulated from the cap.

A number of exemplary embodiments of surge arresters fashioned according to the invention are shown in Figures 1 through 8. Thereby shown are:

- Figure 1 a three-electrode arrester with a first embodiment of clip allocated to the end electrodes;
- Figure 2 a two-electrode arrester with a first embodiment of clip allocated to the two electrodes;
- 5 Figure 3 a partial view of a three-electrode arrester having clips according to Figure 1 and with the short-circuit device allocated to an end electrode, said short-circuit device being combined with an auxiliary discharge path;
- Figure 4 a modification of Figure 3 with an auxiliary electrode fashioned as cap;
- 10 Figure 5 a modification of Figure 3 with rigid retainer shackle for the short-circuit device and a spring washer allocated to the auxiliary electrode. Also shown are:
- Figure 6 a two-electrode arrester with a second embodiment of a clip to be allocated thereto;
- 15 Figure 7 a three-electrode arrester with clips in the form of a cap allocated to the end electrodes; and
- Figure 8 a partial view of a three-electrode arrester with clips according to Figure 7 and with the short-circuit device allocated to an end electrode, said short-circuit device being combined with an auxiliary discharge path.
- 20

Figure 1 shows a schematic illustration of a three-electrode arrester 1 that comprises the two ceramic insulators 11 and 12 at both sides of a middle electrode 13 and on whose one end electrode (not shown) an electrical terminal in the form of a tightly fitting clip 2 is put in place. An identical clip 2 is shown next to the end

25 electrode 14. This clip, which is composed of an annular metal band 21 whose ends are soldered or welded to form a terminal 22, has its circumference provided with a two-legged, clamp-like batter 23 lying approximately opposite the terminal 22, as a result whereof the clip 2 is rendered resilient in circumferential direction. The clip can be slipped onto the flange-like foot part 15 of the end electrode 14, whereby the

30 dimensions of the foot part 15 of the end electrode 14 and of the clip 2 are selected such that an adequate contact pressure is established. In particular, the diameter of the

foot part 15 should be slightly larger than the diameter of the ceramic insulator 11 or, respectively, 12.

Figure 2 shows a two-electrode arrester that comprises a ceramic insulator 31, a first end electrode 33 as well as a second end electrode (not shown in detail),  
 5 whereby a resiliently fashioned clip 2 is put in place on each end electrode.

Figure 3 shows portions of a three-electrode arrester according to Figure 1 that is augmented by a short-circuit device and combined with auxiliary discharge paths. In this case, the width b of the clip 24 put in place onto the end electrode 14 is selected so large that the clip not only embraces a part of the surface of the ceramic  
 10 insulator 12 but also projects axially beyond the end electrode 14. As a result thereof, a cylindrical space is formed in which a disk 4 of a fusible material and a spacer 5 in the form of a varistor are arranged, whereby the spacer 5 is arranged centered within the clip 24 by means of a rubber-like ring 6. The assembly composed of fusion disk 4 and varistor 5 also has a centrally perforated auxiliary electrode 7 allocated to it that  
 15 lies against the spacer/varistor 5 and is held by the free end of a spring clip 8 fixed to the middle electrode 13. The fusion disk 4 melts in case of overload, whereupon the auxiliary electrode 7 contacts the edge of the clip 24.

Figure 4 shows a modification of Figure 3, whereby the critical difference is comprised therein that a cap-shaped auxiliary electrode 84 is provided instead of a  
 20 disk-shaped auxiliary electrode, a fusion disk 41 and a spacer/varistor 5 being arranged in said auxiliary electrode 84 and the edge 85 thereof residing opposite the foot part 15 of the end electrode within the projecting region of the clip 24. The auxiliary electrode 84 is arranged centered by an insulating ring 10 and is held spaced and insulated from the clip 24.

Figure 5 shows another modification of Figure 3, whereby the critical  
 25 difference is comprised therein that the contact to the middle electrode 13 is produced via a non-resilient, U-shaped shackle 82 that presses a spring washer 83 against the auxiliary electrode 71. The spring washer -- shown in its relaxed condition to the right of the arrester -- lies against the disk-shaped auxiliary electrode 71 that has both  
 30 sides provided with centering surfaces 72 or, respectively, 73 for the centered

allocation of the spring washer 83 and for the centered allocation of the spacer/varistor 5 within the projecting region of the clip 24.

Figure 6 shows a two-electrode arrester 3 with ceramic insulator 31 and end electrodes 33 and 34, whereby a clip 25 in the form of a cap with a hollow-cylindrical edge region 26 and a planar cover region 27 provided with a center opening 28 is to be allocated to each end electrode. The cap 25 is also implemented with a power terminal 29. Further, the cap has the circumference of the edge region 26 provided with a plurality of point-like or bead-like impressions 30 that, when the cap 25 is slipped onto an end electrode, result therein that the cap resiliently presses at the foot region of the respective end electrode and contacts this.

Figure 7 shows a three-electrode arrester 1 on whose end electrodes a respective cap 25 is put in place. According to Figure 8 and given a three-electrode arrester according to Figure 7, the cap can likewise be part of a short-circuit device connected to the middle electrode 13 and can potentially additionally be part of an auxiliary discharge path connected electrically parallel to the gas discharge path of the arrester. A cap 25 having adequate height  $h$  in order to be able to arrange a fusion disk 4 and a spacer 5 within the cap is employed for this purpose, whereby the spacer in the form of a varistor is arranged upon employment of an insulating centering member 9 in order to suppress a short-circuit between the free end 84 of the spring clip 8 and the cap 25 in the normal operating condition.



## Patent Claims

1. Gas-filled surge arrester with at least two electrodes, whereof two electrodes are fashioned as end electrodes with a flange-like foot part, and with at least one hollow-cylindrical ceramic insulator whose face end is soldered to the foot part of an electrode and to a further electrode, whereby the foot part of each end electrode has an electrical terminal allocated to it in the form of a tightly fitting clip that also embraces the ceramic insulator adjacent to the foot part over a part of its axial length and whose radially projecting ends are positively connected to one another, characterized in that each clip (2; 24, 25) is resiliently fashioned in circumferential direction.

2. Gas-filled surge arrester according to claim 1, characterized in that the clip is provided by means of a two-legged, clamp-like batter (23).

3. Gas-filled surge arrester according to claim 1 or 2, whereby a middle electrode as third electrode is arranged in addition to two end electrodes, characterized in that the clip (24) projects axially beyond the foot part (14) of the respective end electrode, whereby the projecting region has parts of a short-circuit device (4, 7, 24) (fail-safe mechanism) electrically connected to the middle electrode allocated to it.

4. Gas-filled surge arrester according to claim 3, characterized in that parts of an auxiliary discharge path (5) circuited electrically parallel to the gas discharge path are additionally allocated to the projecting region of the clip (24).

5. Gas-filled surge arrester according to claim 4, characterized in that the short-circuit device comprises a disk-shaped auxiliary electrode (7) whose diameter is at least equal to the outside diameter of the clip (24) and that is held spaced from the edge of the clip by means of a fusion disk (4) and a spacer (5) that are arranged within the projecting part of the clip, and that is pressed against the spacer (5) with a spring (8).

6. Gas-filled surge arrester according to claim 5, characterized in that the spacer (5) is composed of a varistor.

7. Gas-filled surge arrester according to claim 5 or 6, characterized in that the spring (81) is fixed by means of a U-shaped shackle (82) fixed to the middle electrode.

8. Gas-filled surge arrester according to claim 7, characterized in that the  
5 spring is fashioned as coil spring (81) or a spring washer (83).

9. Gas-filled surge arrester according to claim 1, characterized in that the clip comprises the form of a cap (25) with a hollow-cylindrical edge region (26) and a planar cover region (27) provided with a central opening (28), whereby the edge region (26) has its circumference provided with a plurality of bead-like impressions  
10 (30) lying against the foot part of the respective end electrode (33).

10. Gas-filled surge arrester according to claim 9, whereby a middle electrode as third electrode is arranged in addition to two end electrodes, characterized in that the clip (25) projects axially beyond the foot part (15) of the respective end electrode (14), whereby the projecting region is part of a short-circuit device (4; 84) (fail-safe  
15 mechanism) electrically connected to the middle electrode.

11. Gas-filled surge arrester according to claim 9, characterized in that the clip (25) is additionally part of an auxiliary discharge path (5) circuited electrically parallel to the gas discharge path.

12. Gas-filled surge arrester according to claim 11, characterized in that  
20 the short-circuit device is formed by the planar cover surface (27) of the cap (25) and by that end (84) of a spring clip (8) connected to the center electrode (13) that is free and engages into the center opening (28) of the cap, whereby the free end (84) of the spring clip is held spaced from the planar cover surface (27) of the cap by means of a fusion disk (4) and the auxiliary discharge path (5) that are arranged within the cap  
25 (25), and the fusion disk (4) or the auxiliary discharge path (5) is insulated from the planar cover surface (27) of the cap (25) by means of an insulating centering member (9).

13. Gas-filled surge arrester according to claim 12, characterized in that the auxiliary discharge path (5) is composed of a varistor that is arranged insulated by  
30 means of the insulating centering member (9).

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IN THE UNITED STATES ELECTED OFFICE OF  
THE UNITED STATES PATENT AND TRADEMARK OFFICE  
UNDER THE PATENT COOPERATION TREATY - CHAPTER II

SUBMISSION OF PROPOSED DRAWING CHANGES

5 APPLICANTS: Jürgen Boy and Peter Bobert

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INVENTION: "GAS-FILLED SURGE DIVERter WITH ELECTRODE  
CONNECTIONS IN THE SHAPE OF BAND-TYPE CLIPS"

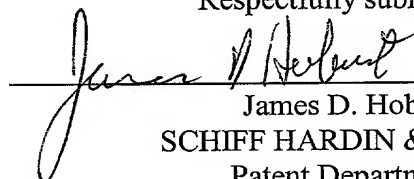
**BOX PCT**

15 Assistant Commissioner for Patents  
Washington, D.C. 20231

S I R:

Applicants propose to amend the drawings by deleting applicants' reference  
number and by adding element numbers, as indicated in red in the attached two  
20 sheets of drawings.

Respectfully submitted,

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DATED: December 12, 2001

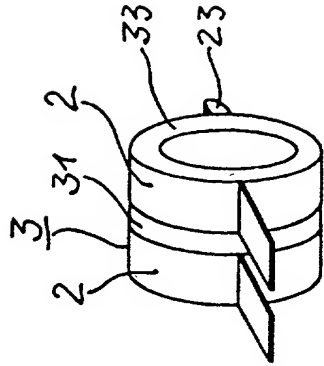


FIG 2

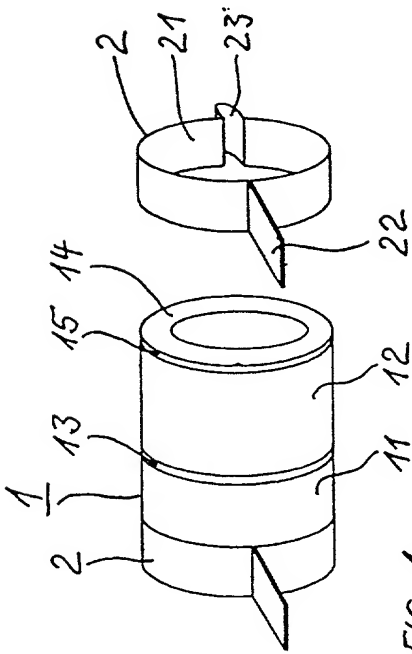


FIG 1

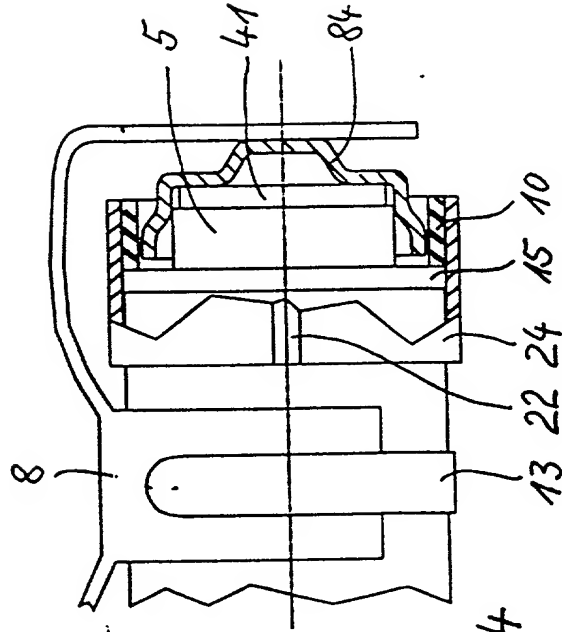


FIG 4

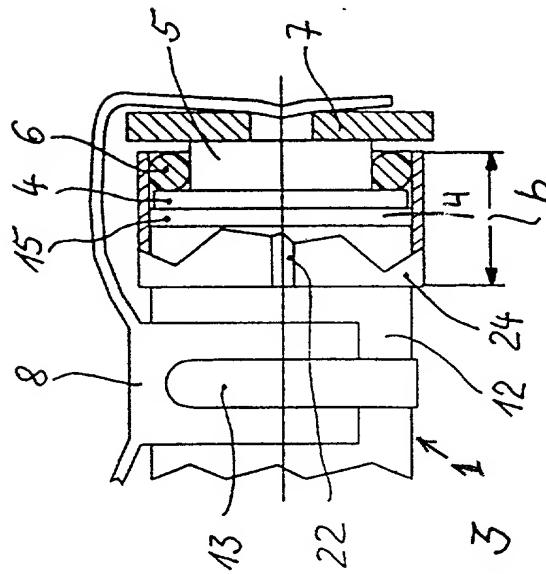
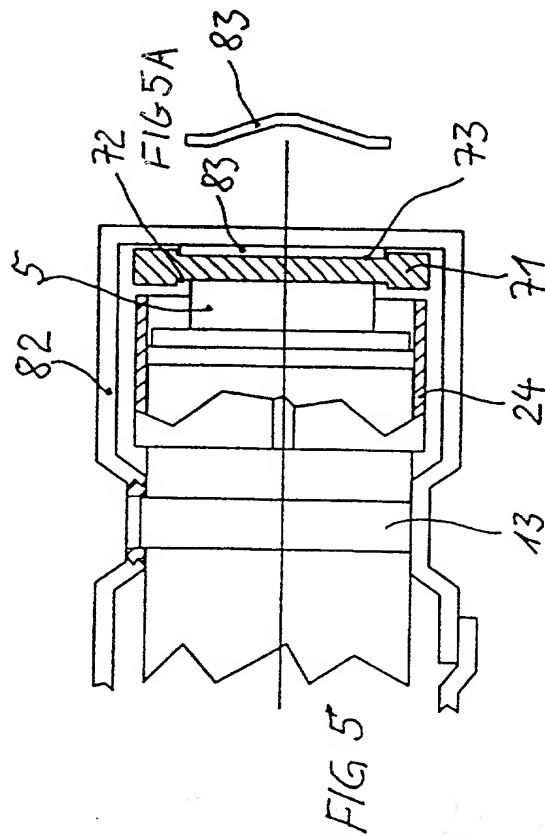
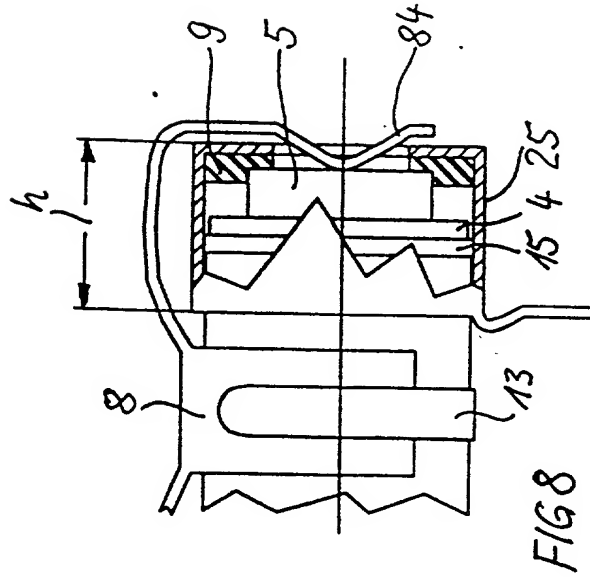
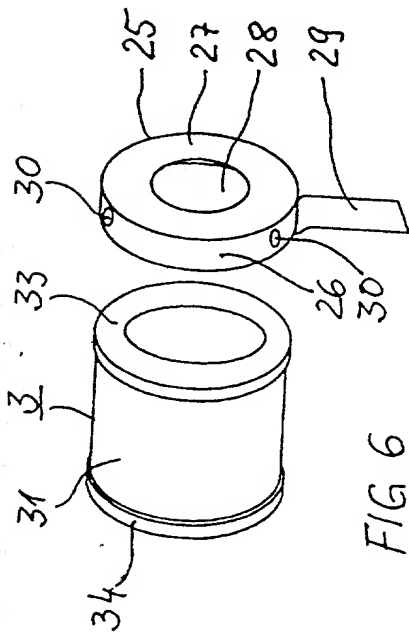
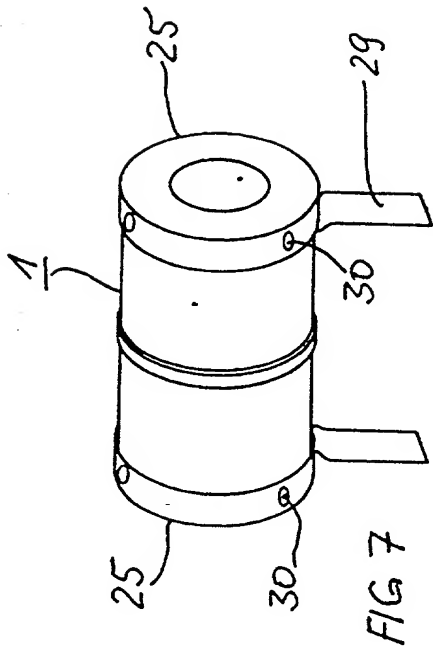


FIG 3



- 1 -

IN THE UNITED STATES ELECTED OFFICE OF  
THE UNITED STATES PATENT AND TRADEMARK OFFICE  
UNDER THE PATENT COOPERATION TREATY - CHAPTER II

SUBMISSION OF DRAWINGS

5 APPLICANTS: Jürgen Boy and Peter Bobert

ATTORNEY

DOCKET NO.: P01,0467

SERIAL NO.:

EXAMINER:

FILING DATE:

ART UNIT:

10 INTERNATIONAL APPLICATION NO.: PCT/DE00/01862

INTERNATIONAL FILING DATE: 7 June 2000

INVENTION: "GAS-FILLED SURGE DIVERter WITH ELECTRODE  
CONNECTIONS IN THE SHAPE OF BAND-TYPE CLIPS"

**BOX PCT**

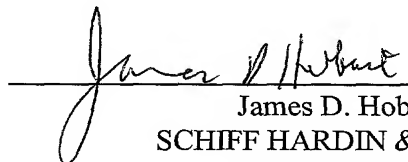
15 Assistant Commissioner for Patents  
Washington, D.C. 20231

S I R:

Attached herewith are two sheets of Formal Drawings containing Figs. 1-8.

Respectfully submitted,

20

 (Reg. No. 24,149)  
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25

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DATED: December 12, 2001

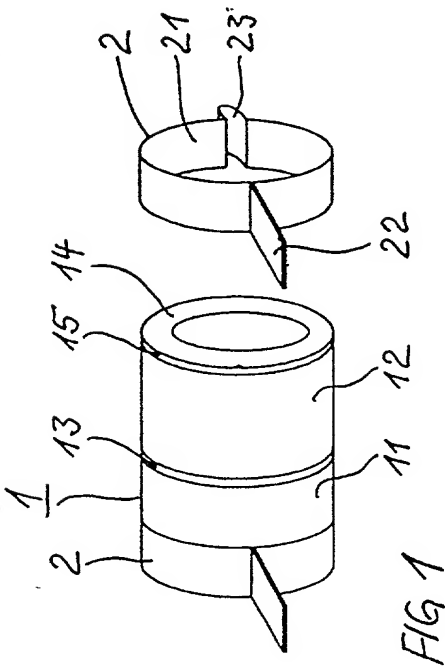


FIG 1

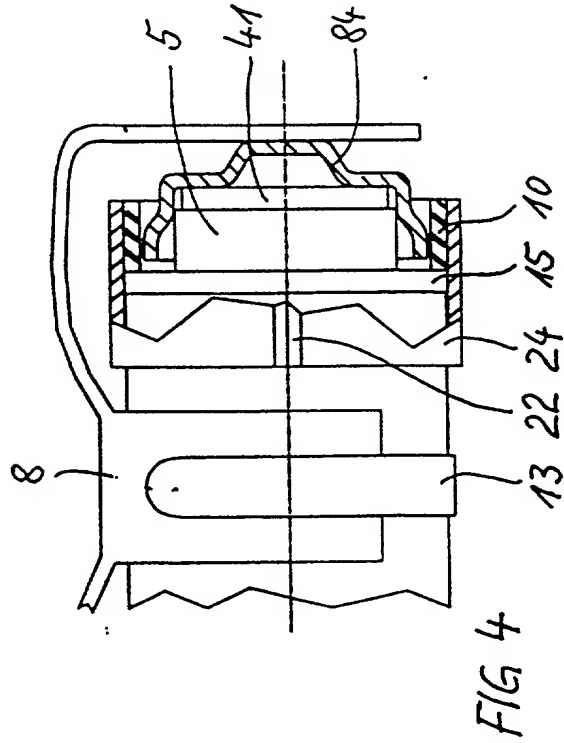


FIG 2

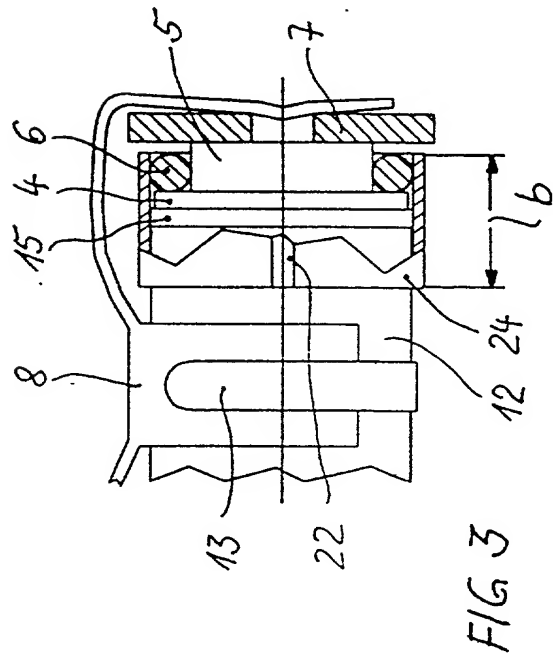


FIG 3

FOOTPRINT

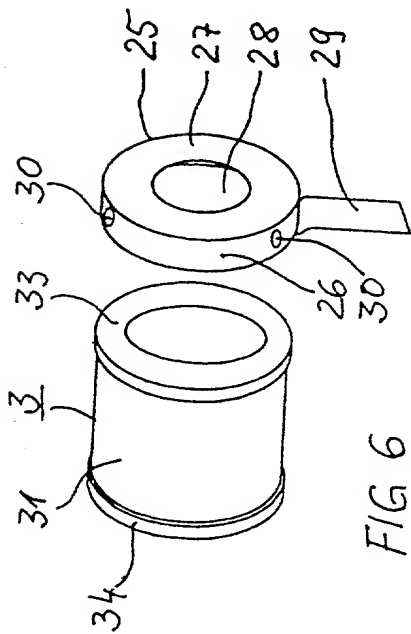


FIG 6

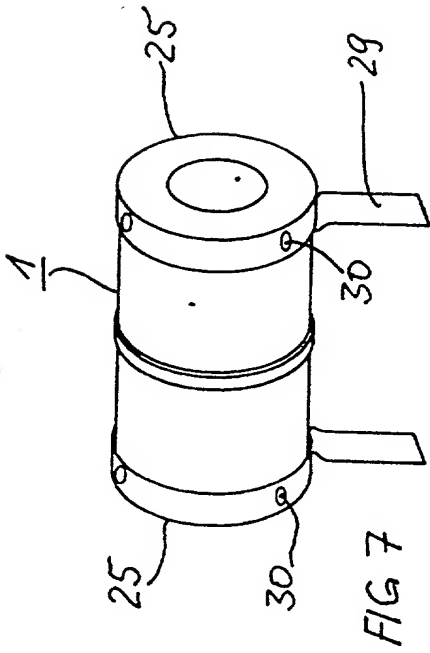


FIG 7

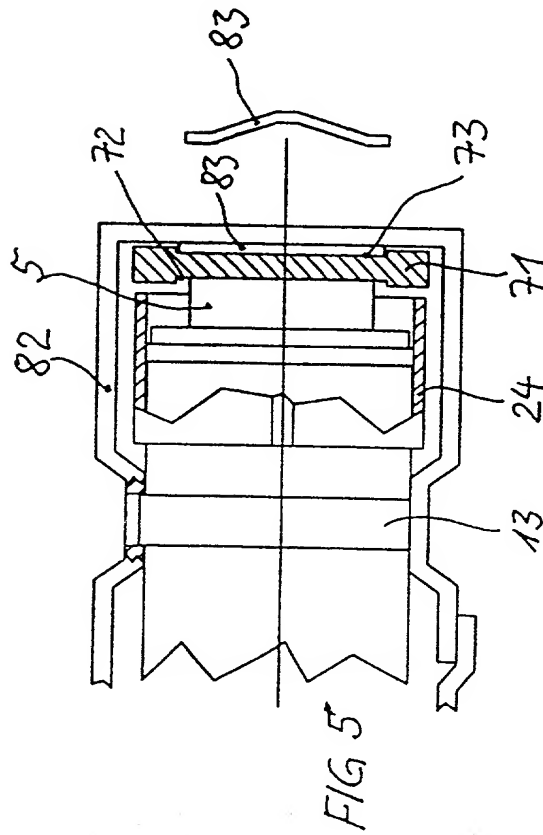


FIG 5

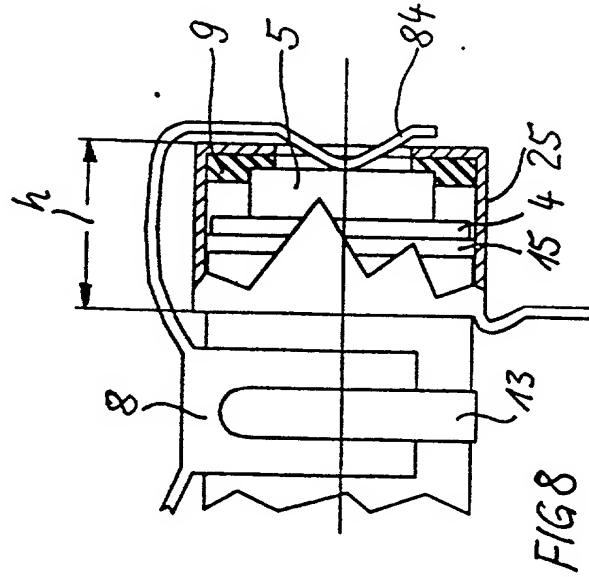


FIG 8



**COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY**  
(Includes Reference to PCT International Applications)ATTORNEY'S  
DOCKET NUMBER  
P01,0467

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name. I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**"GAS-FILLED SURGE DIVERTER WITH ELECTRODE CONNECTIONS  
IN THE SHAPE OF BAND-TYPE CLIPS"**

the specification of which (check only one item below):

- ☐ is attached hereto.
- ☐ was filed as United States application  
Serial No. \_\_\_\_\_  
on \_\_\_\_\_  
and was amended  
on \_\_\_\_\_ (if applicable).
- ☒ was filed as PCT international application  
Number PCT/DE00/01862  
on 7 June 2000  
and was amended under PCT Article 19  
on \_\_\_\_\_ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

**PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:**

COUNTRY (If PCT indicate "PCT")	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 USC 119
Germany	199 28 322.2	16 June 1999	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO
			<input type="checkbox"/> YES <input type="checkbox"/> NO

<b>Combined Declaration For Patent Application and Power of Attorney</b> <b>(Continued)</b> <small>(Includes Reference to PCT International Applications)</small>				<b>ATTORNEY'S DOCKET NO.</b> <b>P01,0467</b>	
I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56 which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:					
<b>PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:</b>					
<b>U.S. APPLICATIONS</b>				<b>STATUS (Check one)</b>	
<b>U.S. APPLICATION NUMBER</b>		<b>U.S. FILING DATE</b>		<b>PATENT ED</b>	<b>PENDING</b>
<b>PCT APPLICATIONS DESIGNATING THE U.S.</b>					
<b>PCT APPLICATION NO</b>		<b>PCT FILING DATE</b>		<b>U.S. SERIAL NUMBERS ASSIGNED (if any)</b>	
<b>POWER OF ATTORNEY:</b> As a named inventor, I hereby appoint all Attorneys identified by United States Patent & Trademark Office Customer Number 26574, who are all members of the Firm Schiff Hardin & Waite.					
<b>Send Correspondence to:</b>				<b>Direct Telephone Calls to:</b>	
<b>SCHIFF HARDIN &amp; WAITE</b> <b>Patent Department</b> <b>6600 Sears Tower, Chicago, Illinois 60606-6473</b>				<b>(312) 258-5781</b>	
<b>1-00</b>  2 0 1	<b>FULL NAME OF INVENTOR</b>	<b>FAMILY NAME</b> <u>Boy</u>	<b>FIRST GIVEN NAME</b> <u>Jürgen</u>	<b>SECOND GIVEN NAME</b>	
	<b>RESIDENCE &amp; CITIZENSHIP</b>	<b>CITY</b> <u>13465 Berlin</u>	<b>STATE OR FOREIGN COUNTRY</b> <u>Germany</u>		<b>COUNTRY OF CITIZENSHIP</b> <u>Germany</u> <i>DEX</i>
	<b>POST OFFICE ADDRESS</b>	<b>POST OFFICE ADDRESS</b> <u>Stolzingerstr. 8b</u>	<b>CITY</b> <u>13465 Berlin</u>		<b>STATE &amp; ZIP CODE/COUNTRY</b> <u>Germany</u>
<b>2-00</b>  2 0 2	<b>FULL NAME OF INVENTOR</b>	<b>FAMILY NAME</b> <u>Robert</u>	<b>FIRST GIVEN NAME</b> <u>Peter</u>	<b>SECOND GIVEN NAME</b>	
	<b>RESIDENCE &amp; CITIZENSHIP</b>	<b>CITY</b> <u>14612 Falkensee</u>	<b>STATE OR FOREIGN COUNTRY</b> <u>Germany</u>		<b>COUNTRY OF CITIZENSHIP</b> <u>Germany</u> <i>DEX</i>
	<b>POST OFFICE ADDRESS</b>	<b>POST OFFICE ADDRESS</b> <u>Kantstr. 57</u>	<b>CITY</b> <u>14612 Falkensee</u>		<b>STATE &amp; ZIP CODE/COUNTRY</b> <u>Germany</u>
<b>2-03</b>  2 0 3	<b>FULL NAME OF INVENTOR</b>	<b>FAMILY NAME</b>	<b>FIRST GIVEN NAME</b>	<b>SECOND GIVEN NAME</b>	
	<b>RESIDENCE &amp; CITIZENSHIP</b>	<b>CITY</b>	<b>STATE OR FOREIGN COUNTRY</b>		<b>COUNTRY OF CITIZENSHIP</b>
	<b>POST OFFICE ADDRESS</b>	<b>POST OFFICE ADDRESS</b>	<b>CITY</b>		<b>STATE &amp; ZIP CODE/COUNTRY</b>
I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.					
<b>SIGNATURE OF INVENTOR 201</b> <i>X Jürgen Boy</i>		<b>SIGNATURE OF INVENTOR 202</b> <i>X Peter Robert</i>		<b>SIGNATURE OF INVENTOR 203</b>	
<b>DATE</b> <i>X 3rd December 2001</i>		<b>DATE</b> <i>X 3rd December 2001</i>		<b>DATE</b>	